IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Deore et al.
Appl. No.	:	10/581,752
371(c)	:	December 20, 2006
Title	:	A SWITCHABLE SELF-DOPED POLYANILINE
Grp./A.U.	:	1766
Examiner	:	Fang, Shane
Docket No.	:	17522NP

Honorable Commissioner of Patents
Alexandria, VA 22313-1450

DECLARATION UNDER 37 C.F.R. § 1.132

Sir:

In accordance with 37 C.F.R. § 1.132, the Applicants submit the following evidence to traverse the rejection of the claims of the above-referenced patent application set forth in a non-final Office action dated April 5, 2011. The declaration is made by Michael S. Freund, who was involved with the conception of the claimed invention and is a named inventor with respect to the above application for patent. Michael S. Freund is also an author of prior art reference Shoji et al. JACS (2002) 124, 12486-12493 and a named inventor of prior art reference Freund et al. U.S. Patent Application Publication 2002/0029979, which the Examiner uses as bases of the rejections of the claims.

Declaration of Michael S. Freund

I, Michael S. Freund, a citizen of Canada, residing at 329 Carpathia Rd, Winnipeg, Manitoba, Canada, R3N 1T4, do hereby state as follows:

I. I received a Bachelor of Science degree (Chemistry) from Florida Atlantic University in 1987 and a Doctor of Philosophy degree (Chemistry) from the University of Florida in 1992.

II. I am a Professor in the Department of Chemistry at the University of Manitoba located in Winnipeg, Manitoba, Canada. I am a Director of the Manitoba Institute for Materials and an Adjunct Professor of Electrical and Computer Engineering at the University of Manitoba. I am also a Canada Research Chair in Conducting Polymers and Electronic Materials. Presently, my research includes the design and synthesis of new conducting polymers and the development of the use of conducting polymers in emerging technologies. Attached to this Declaration and marked "EXHIBIT" is a copy of my current Curriculum Vitae which includes a listing of the publications of which I am an author and a listing of patents or patent applications of which I am an inventor.

III. A poly(aniline boronic acid) taught by the Shoji et al. reference is produced by electrochemical polymerization of 3-aminophenylboronic acid hydrochloride salt in HCl solution in the presence of sodium fluoride. A potential is applied to an electrode, inducing the polymerization reaction and the poly(aniline boronic acid) is deposited in the form of a film on the electrode. The poly(aniline boronic acid) produced by this reaction procedure

taught by the Shoji et al. reference would not be expected to exhibit the solubility properties which would make it capable of converting in solution between a water-insoluble non-self-doped form and a water-soluble self-doped form by a reversible chemical reaction that comprises complexation between boronic acid of the poly(aniline boronic acid) with a saccharide in the presence of fluoride.

IV. Poly(aniline boronic acid) taught by the Freund et al. reference is produced by electrochemical polymerization of 3-aminophenylboronic acid in sulphuric acid aqueous solution in the presence of sodium fluoride and Nafion. A potential is applied to an electrode to drive the polymerization reaction and the poly(aniline boronic acid) is deposited in the form of a film on the electrode. The poly(aniline boronic acid) produced by the reaction procedure taught by the Freund et al. reference would not be expected to exhibit the solubility properties which would make it capable of converting in solution between a water-insoluble non-self-doped form and a water-soluble self doped form by a reversible chemical reaction that comprises complexation between boronic acid of the poly(aniline boronic acid) with a saccharide in the presence of fluoride.

V. The combined teachings of the Shoji et al. reference and the Mattoso et al. Synthetic Metals, 68 (1994), 1-11 reference the Examiner suggests, namely modifying the poly(aniline boronic acid) of the Shoji et al. reference by using polyvinylsulfonic acid or ammonium peroxydisulfate for oxidative polymerization, would not yield a conductive boronic acid substituted polyaniline polymer having a molecular weight of at least 100,000 that is capable of converting between a water-insoluble non-self-doped form and a water-

soluble self-doped form by a reversible chemical reaction that comprises complexation between boronic acid of the polyaniline polymer with a saccharide in the presence of fluoride. Modification of the poly(aniline boronic acid) of the Shoji et al. reference, by using polyvinylsulfonic acid or ammonium peroxydisulfate for oxidative polymerization, would be expected to suffer from precipitation initiated effective termination of the polymerization reaction producing poly(aniline boronic acid) having a molecular weight of less than 100,000.

VI. The combined teachings of the Shoji et al. and Mattoso et al. references the Examiner suggests, namely modifying the poly(aniline boronic acid) of the Shoji et al. reference by using polyvinylsulfonic acid or ammonium peroxydisulfate for oxidative polymerization, and using LiF, NaCl, $CaCl_2$, and $LiNO_3$, would not yield a conductive boronic acid substituted polyaniline polymer having a molecular weight of at least 100,000 that is capable of converting between a water-insoluble non-self-doped form and a water-soluble self-doped form by a reversible chemical reaction that comprises complexation between boronic acid of the polyaniline polymer with a saccharide in the presence of fluoride. Modification of the poly(aniline boronic acid) of the Shoji et al. reference, by using polyvinylsulfonic acid or ammonium peroxydisulfate for oxidative polymerization, and using LiF, NaCl, $CaCl_2$, and $LiNO_3$, would be expected to suffer from precipitation initiated effective termination of the polymerization reaction producing poly(aniline boronic acid) having a molecular weight of less than 100,000.

VII. The combined teachings of the Shoji et al. and Mattoso et al. references the Examiner suggests, namely modifying the poly(aniline boronic acid) of the Shoji et al. reference by using polyvinylsulfonic acid or ammonium peroxydisulfate for oxidative polymerization, using LiF, NaCl, $CaCl_2$, and $LiNO_3$, and lowering the reaction temperature, would not yield a conductive boronic acid substituted polyaniline polymer having a molecular weight of at least 100,000 that is capable of converting between a water-insoluble non-self-doped form and a water-soluble self-doped form by a reversible chemical reaction that comprises complexation between boronic acid of the polyaniline polymer with a saccharide in the presence of fluoride. Modification of the poly(aniline boronic acid) of the Shoji et al. reference, by using polyvinylsulfonic acid or ammonium peroxydisulfate for oxidative polymerization, using LiF, NaCl, $CaCl_2$, and $LiNO_3$, and lowering the reaction temperature, would be expected to suffer from precipitation initiated effective termination of the polymerization reaction producing poly(aniline boronic acid) having a molecular weight of less than 100,000.

VIII. The combined teachings of the Freund et al. and Mattoso et al. references the Examiner suggests, namely modifying the poly(aniline boronic acid) of the Freund et al. reference by using polyvinylsulfonic acid or ammonium peroxydisulfate for oxidative polymerization, would not yield a conductive boronic acid substituted polyaniline polymer having a molecular weight of at least 100,000 that is capable of converting between a water-insoluble non-self-doped form and a water-soluble self-doped form by a reversible chemical reaction that comprises complexation between boronic acid of the polyaniline

polymer with a saccharide in the presence of fluoride. Modification of the poly(aniline boronic acid) of the Freund et al. reference, by using polyvinylsulfonic acid or ammonium peroxydisulfate for oxidative polymerization, would be expected to suffer from precipitation initiated effective termination of the polymerization reaction producing poly(aniline boronic acid) having a molecular weight of less than 100,000.

IX. The combined teachings of the Freund et al. and Mattoso et al. references the Examiner suggests, namely modifying the poly(aniline boronic acid) of the Freund et al. reference by using polyvinylsulfonic acid or ammonium peroxydisulfate for oxidative polymerization, and using LiF, NaCl, $CaCl_2$, and $LiNO_3$, would not yield a conductive boronic acid substituted polyaniline polymer having a molecular weight of at least 100,000 that is capable of converting between a water-insoluble non-self-doped form and a water-soluble self-doped form by a reversible chemical reaction that comprises complexation between boronic acid of the polyaniline polymer with a saccharide in the presence of fluoride. Modification of the poly(aniline boronic acid) of the Freund et al. reference, by using polyvinylsulfonic acid or ammonium peroxydisulfate for oxidative polymerization, and using LiF, NaCl, $CaCl_2$, and $LiNO_3$, would be expected to suffer from precipitation initiated effective termination of the polymerization reaction producing poly(aniline boronic acid) having a molecular weight of less than 100,000.

X. The combined teachings of the Freund et al. and Mattoso et al. references the Examiner suggests, namely modifying the poly(aniline boronic acid) of the Freund et al. reference by using polyvinylsulfonic acid or ammonium peroxydisulfate for oxidative

polymerization, using LiF, NaCl, $CaCl_2$, and $LiNO_3$, and lowering the reaction temperature, would not yield a conductive boronic acid substituted polyaniline polymer having a molecular weight of at least 100,000 that is capable of converting between a water-insoluble non-self-doped form and a water-soluble self-doped form by a reversible chemical reaction that comprises complexation between boronic acid of the polyaniline polymer with a saccharide in the presence of fluoride. Modification of the poly(aniline boronic acid) of the Freund et al. reference, by using polyvinylsulfonic acid or ammonium peroxydisulfate for oxidative polymerization, using LiF, NaCl, $CaCl_2$, and $LiNO_3$, and lowering the reaction temperature, would be expected to suffer from precipitation initiated effective termination of the polymerization reaction producing poly(aniline boronic acid) having a molecular weight of less than 100,000.

XI. The undersigned being warned that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001, and that such willful false statements and the like may jeopardize the validity of the application and or any patent issuing therefrom, declares that all statements made of my own knowledge are true and all statements made on information and belief are believed to be true.

Respectfully submitted,

By: _____
Michael S. Freund

Date: October 4, 2011

EXHIBIT

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Dr. Michael S. Freund, Ph.D.
Professor of Chemistry
Adjunct Professor of Electrical and Computer Engineering
Canada Research Chair in Conducting Polymers and Electronic Materials
Manitoba Institute for Materials, Director

PERSONAL DATA: Born January 12, 1964 in Gainesville, Florida
Naturalized Canadian Citizen May 1, 2007

PROFESSIONAL EXPERIENCE:

Professor of Chemistry University of Manitoba	April 2007 – present
Director of the Manitoba Institute for Materials University of Manitoba	November 2010 – present
Adjunct Professor of Electrical and Computer Engineering University of Manitoba	October 2006 – present
Canada Research Chair (Tier 2) Renewed 2008	November 2003 – present
Associate Professor of Chemistry University of Manitoba	May 2003 – April 2007
Assistant Professor of Chemistry University of Manitoba	July 2002 – May 2003
Director of the Molecular Materials Center California Institute of Technology	July 1999 July 2002
Assistant Professor of Chemistry Lehigh University	July 1994 – July 1999
Postdoctoral Fellow California Institute of Technology Advisor: Nathan S. Lewis	August 1992 – July 1994

EDUCATION:

Ph. D., University of Florida (Advisor: Anna Brajter-Toth) Title: *Surface Microstructure and its Effect on Electrode Response*	August 1992
B. S., Chemistry, Florida Atlantic University (Advisor: Frank A. Schultz)	April 1987

PRINCIPAL RESEARCH INTERESTS:
Research in my group can be divided into four broad areas: analytical chemistry (electrochemistry, sensor arrays and artificial neural networks), material science (conducting polymers and polymer interfaces), surface science (scanning probe microscopy, ESCA as well as novel approaches to surface modification) and conducting polymer-based electronics.

AWARDS AND HONORS:
Awarded a Tier 2 Canada Research Chair (2003, 2008); Recipient of a 2009 and 2008 University Merit Awards for Research and Service; Recipient of a 2004 University Merit Award for Research and Scholarly work; Invited participant in a special issue of the *Analyst* (2003) devoted to "Global Emerging Investigators"; Invited participant in the Federation of Analytical Chemistry & Spectroscopy Societies' 2000 Young Investigator symposium entitled "Nurturing the Forces that will Shape 21st Century Analytical Chemistry"; Invited participant in a special edition of *Analytica Chimica Acta* (1999) entitled "Looking to the Future of Analytical Chemistry".

ASSOCIATIONS AND AFFILIATIONS:
American Chemical Society (ACS), Chemical Institute of Canada (CIC), American Association for the Advancement of Science (AAAS), Society of Electroanalytical Chemists (SEAC), Electrochemical Society (ECS)

BOARDS AND EXECUTIVE POSITIONS: Member of NSERC's Grant Selection Committee (26) 2008 – present (co-chair 2009-present); member of University Senate and Senate's Planning and Priorities Committee, 2009 – present; member of the Academic Enhancement and Synergy committee as part of the University's Optimizing Academic Resources initiative, 2010; member of the President's Budget Advisory Committee, 2009 – present; member at large for the Canadian section of the Electrochemical Society, 2009 – present; secretary, CIC Materials Division, 2010-present; member of the Royal Society's Editorial Board of the *Proceedings of the Royal Society A, Mathematical and Physical Sciences*, 2006 – present; vice chair, Philadelphia section of the Electrochemical Society, 1996 – 1997; Secretary, Philadelphia section of the Electrochemical Society, 1995

RESEARCH (University of Manitoba):
My group at the University of Manitoba (1999-present) has consisted of, on average, two postdoctoral fellows, three graduate students and three undergraduate researchers. NSERC and CRC funded research programs being pursued in my group continue in the area of **conducting polymer-based sensors** as well as new synthetic strategies for creating **conducting polymers with enhanced mechanical and electronic properties as well as tunable nanostructures**. I have established collaborative research projects in the areas of **electrochemically directed self-assembly** (G. Ferguson, Chemistry, Lehigh U.), **polymer-based electronics** (D. Thomson, EE, UofM), **integrated circuit sensor arrays** (D. Buchanan, EE, UofM), **carbon dioxide sensors** (D. Jayas, BE, UofM), and **artificial photosynthesis** (N. Lewis, Chemistry, Caltech). During my seven years at the University of Manitoba I have been responsible for securing **over 18 million dollars in research funding** including a 1 million dollar upgrade of the departmental instrumental laboratory used for both undergraduate training and faculty research as well as a 7.4 million dollar multi-investigator CFI infrastructure award for a materials characterization facility.
http://home.cc.umanitoba.ca/~mfreund/materials/

FUNDING:

Over 18 million dollars of research and infrastructure funding over the past seven years.

Current Support

NSERC – RTI (*co-investigator*)	Spectroscopic Ellipsometry for Advanced CMOS, MEMs, and Polymer-based Materials and Devices (*Buchanan + 4 co-applicants*)	$127,552	04/01/10
STEM STIC (*lead investigator*)	International Collaboration for Developing New Clean and Renewable Energy Systems (*Freund + 3 co-applicants*)	1,200,000	02/01/09-03/31/12
NSERC - Egage	Enhanced Anodic Corrosion Protection for Steel-concrete Composite Structures	$24,000	06/01/11-12/30/11
U of M Academic Enhancement Fund	Manitoba Institute for Materials – Research Development Manager	75,000	03/01/10-04/30/11
CRC Tier 2	Chair for Conducting Polymers	500,000	10/01/08-09/30/13
NSERC – RTI (*co-investigator*)	X-ray Energy Dispersive Spectrometer for Environmental Scanning Electron Microscope (*Chatervedi + 5 co-applicants*)	73,840	04/01/09
CFI-LOF-E (*co-investigator*)	Fabrication and Characterization of Self-Assembled Soft and Nanoscale Materials (*Hegmann*)	959,962	07/01/08
NSERC – Strategic (*co-investigator*)	Field Modulated Conducting Polymers for Nanoelectronics (*Thomson +2 co-applicants*)	192,800	03/01/08-02/28/10
NSERC – Strategic (*co-investigator*)	Design, Fabrication and Evaluation of an Integrated CO_2-Odour Sensor for Grain Quality Monitoring (*Jayas +4 co-applicants*)	380,000	01/01/08-12/30/10
NSERC – Discovery	Functionalized Conducting Polymers	225,000*	07/01/07-06/31/12
Defense R&D Canada	Novel Supercapacitor Materials for High Output Pulse Energy Applications	150,000	04/01/06-03/31/09
Western Economic Diversification (*co-investigator*)	Biomedical Engineering: Enhancement of Biomedical Imaging &Biosensors Research Facilities (*LoVetri +9 co-applicants*)	3,200,000	04/01/07-03/31/10
CFI – Innovation (*lead investigator*)	Infrastructure Operating Funds (*Freund +9 co-applicants*)	892,500	04/01/05-04/01/10

* Committee 26 experienced a 9 % across-the-board cut in funding provided researchers up for renewal in this competition year due to extreme budgetary pressures. They have indicated in a correspondence to me that the smaller than average cut should be viewed as a positive assessment of my "dynamic research program."

Additional Support over the Past 6 years

CRC Tier 2	Chair for Conducting Polymers	500,000	10/01/03-09/30/08
Western Economic Diversification (*co-investigator*)	Composites Research and Commercialization Centre (*Jayaraman+9 co-applicants*)	1,500,000	01/01/08
ShawCor Ltd.	Investigation of PABA-based Anti-corrosion Coating System for Steel	20,500	04/04/07-07/31/07
NSERC – Research Tools (*co-investigator*)	Precision Ion Milling System (*Chaturvedi+6 co-applicants*)	123,000	07/01/07
NSERC – Research Tools (*co-investigator*)	FT-IR Microscope (*Gough+3 co-applicants*)	150,000	07/01/07
Western Economic	Manitoba Chemical Analysis Laboratory	1,033,000	01/12/06

Diversification/Varian	*(Freund+3 co-applicants)*		
NSERC – Discovery	Functionalized Conducting Polymers	240,000	07/01/02-06/31/07
CFI – Innovation *(lead investigator)*	Manitoba Materials and Surface Characterization Facility *(Freund+9 co-applicants)*	7,453,250	03/01/04-03/01/06
Defense R&D Canada	Controlled Chemical Polymerization Method for Processing Conducting Polymers	60,000	02/01/04-03/31/05
NSERC – Equipment *(co-investigator)*	Highly Sensitive Differential Scanning Calorimeter *(Hegmann+1 co-applicant)*	106,795	07/01/04
CFI - CRC	Chair for Conducting Polymers	382,384	10/01/03

RESEARCH HIGHLIGHTS

Conducting Polymers:

"The Hard Stuff", *Nature*, **436**: 307 (2005).

Electrochemical Actuation:

Chemical Engineering and Technology invited "Research News" article, *Chemical Engineering and Technology*, **26**: 1007-1001 (2003).

Electrochemically Directed Self Assembly:

Angewandte Featured "Hot Paper," *Angew. Chem. Int. Ed. Engl.*, **39**: 1277-1230 (2000).

"Monolayers Assemble Selectively on Gold," *Chemical and Engineering News*, April 10, p48 (2000).

Monolayer Stability:

"Blame it on the Gold," December 1st issue of *Analytical Chemistry*, p768A (1998).

Electronic Nose:

"A Sent Circuit," by Mike May, Associate Editor, *American Scientist*, **84**(1): 24-25 (1996).

"The Electronic Nose," by Gary Taubes, *Discover*, September, 40-50 (1996).

"Electronic 'Noses' Made from Conductive Polymeric Films," *NASA Tech Briefs*, July, 60-62 (1997).

PATENTS: (22 issued; 5 applications; 3 provisional)

Issued

Spatiotemporal and geometric optimization of sensor arrays for detecting analytes in fluids: US7,595,023 (**2009**), US7,122,152 (**2006**)

Use of spatiotemporal response behavior in sensor arrays to detect analytes in fluids: US7,189,353 (**2007**), US6,962,675 (**2005**), US6,455,319 (**2002**)

Use of an array of polymeric sensors of varying thickness for detecting analytes in fluids: US7,144,553 (**2006**), US6,759,010 (**2004**), US6,610,367 (**2003**), US6,387,329 (**2002**)

Electrochemically directed self-assembly of monolayers on metal: US6,818,117 (**2004**)

Sensors and sensing methods for detecting analytes based on changes in pKa of a sensing polymer: US6,797,152 (**2004**)

Nanoparticle-based sensors for detecting analytes in fluids: US6,773,926 (**2004**)

Synthesis of substituted poly(aniline)s: US6,737,504 (**2004**)

Sensor arrays for detecting microorganisms: US6,017,440 (**2000**)

Sensor arrays for detecting analytes in fluids: US6,013,229 (**2000**), US6,010,616 (**2000**), US5,959,191 (**1999**), US5,951,846 (**1999**), US5,891,398 (**1999**), US5,698,089 (**1997**), US5,571,401 (**1996**)

Light directed modification fluoropolymers: US5,859,086 (**1999**)

Pending
Metastable Reaction Mixtures For In Situ Polymerization of Conducting Polymers, US20090299031
Self-doped Polyaniline Nanoparticle Dispersions based on Boronic acid… CA2009001679 (PCT)
Conducting Polymer for Electronic, Photonic and Electromechanical Systems, US20070940478
Switchable self-doped polyaniline, US20070093644
Tunable Conducting Polymer Nanostructures, US20060759957

Provisional
A Plasmonic Device, System and Methods, 61/312,388
Carbon Dioxide Detector and Method of Use 61/238,914
Tunable Diode, 61/182,013

TEACHING:

Undergraduate Courses (University of Manitoba):

3590 Instrumental Analysis, 3 credit (2006, 2007, 2009, 2010)
4590 Bioanalytical Chemistry, 3 credit (2009)
02.347 Instrumental Analysis, 6 credit (2002, 2003, 2004, 2005)
02.460 Advanced Chemical Techniques, 3 credit (2003, 2004)
02.471 Research Projects in Chemistry, 6 credits (2004, 2005, 2008, 2009, 2010)

Undergraduate Courses (Lehigh):

Analytical Chemistry Laboratory (1996, 1997)
Instrumental Analysis Laboratory (1997, 1998, 1999)
Instrumental Analysis Lecture (1997, 1998, 1999)

Graduate Courses (University of Manitoba):

02.770 Advanced topics in Electrochemistry (2003, 2006, 2008, 2009)
02.770 Seminars in Current Topics (2004 - 2009; *co-taught*)
02.746 Chemical and Electrochemical Synthesis of Conducting and Redox Polymers (2005, 2007)

Graduate Courses (Lehigh):

Chemometrics (1996, 1998)
Electroanalytical Chemistry (1995, 1997, 1999)

Graduate Courses (Caltech):

Introduction to Electrochemistry (2001; *co-taught with F.C. Anson and N.S. Lewis*)

CURRICULUM DEVELOPMENT (University of Manitoba):
Recently led an effort to integrate Instrumental courses offered by both the Faculty of Science and Environment, to offer a new Biotechnology focused Instrumental Analysis course and to upgrade undergraduate instrumental facilities in the Department of Chemistry. Currently leading a Department initiative to create new undergraduate and graduate courses in Materials Chemistry.

DEPARTMENTAL/UNIVERSITY PARTICIPATION (University of Manitoba):
Was the lead investigator on both a CFI Innovation proposal ($7.4M, 2004) to secure major research instrumentation for the University as well as a Western Economic Development project ($1M, 2007) to secure chemical analysis instrumentation for the Department; Department Curriculum Committee 2002-present; Department Advisory Committee 2002-present; Faculty

Research Committee 2003-present; Currently serving on 5 graduate student committees. Member of the Senate Committee on University Research (SCUR) 2003-2009. Physics Head Search Committee, 2003; Chemistry Instructor Search Committee, 2003; Maritime Graduate Recruiting Tour, 2004; CRC SIMS search committee, 2004; Chemistry Inorganic Faculty search committee, 2004; Physics NSERC Industrial Research Chair search committee, 2004; Science's Advanced Materials CRC search committee, 2005; CFI Advisory Committee, 2005-present; Office of Research Services evaluation committee, 2007.

COMMUNITY SERVICE

Member of NSERC Chemistry Grant Selection Committee (2008-2011), co-chair 2009-2011. Invited guest editorial in the *Analyst*, **129**: 283 (2004); Invited member to the CIHR workshop on "Integrating the Physical & Applied Sciences into Biomedical Research," 2003 and 2006; Member of the Canada Research Chair College of Reviewers, 2003 – present; Session organizer for 88th Canadian Chemistry Conference (Saskatoon); Macromolecular Division organizer for 90th Canadian Chemistry Conference (Winnipeg); External review committee member for Trent-UOIT Master of Science (MSc) in Materials Science (2006); External review committee member for the Saskatchewan Structural Sciences Centre (2011).

PUBLICATIONS AND PRESENTATIONS: (corresponding author*, HQP under my direct supervision: *undergraduate student*, graduate student, **PDF**)

Books

(1) M. S. Freund* and **B. A. Deore** "Self-Doped Conducting Polymers" *Wiley and Sons*, ISBN: 978-0-470-02969-5, **2007** (*Sales*: 429('07), 107 ('08), 25 ('09), 37('10); **598** units total)

Manuscripts

(1) T. A. Emadi, C. Shafai, D. J. Thomson, M. S. Freund*, D. S. Jayas*, N. D. G. White: "Micromachined Polymer-based Chemicapacitor Sensor on Heated Platform" *Sensors & Actuators: B submitted*

(2) M. E. Hossain, **A. Rahman**, M. S. Freund*, N. D.G. White, C. Shafai, D. J. Thomson, and D. S. Jayas*: "Fabrication and Optimization of a Conducting Polymer Sensor Array Using Stored Grain Model Volatiles. *J. Agric. Food Chem.* (ACS) *submitted*

(3) M. E. Hossain, M. S. Freund*, N. D. G. White, C. Shafai, D. J. Thomson and D. S. Jayas* "Carbon Black Polymer Sensor Array for Incipient Grain Spoilage Monitoring" *Biosys. Eng. submitted*

(4) T. Senthilkumar, D.S. Jayas*, N. D. G. White, M. S. Freund*, C. Shafai and D. J. Thomson: "Characterization of Volatile Organic Compounds Released by Granivorous Insects in Stored Wheat" *J. Agric. Food Chem.* (ACS) *submitted*

(5) R. G. Pillai and M. S. Freund*: "Self-Assembly of Alkylthiosulfates on Gold: Role of Electrolyte and Trace Water in the Solvent" *Langmuir*, **27**: 9028 – 9033 (2011)

(6) M. McDonald and M. S. Freund*: "A Novel Conducting Polymer-Heteropoly Acid Hybrid Material for Artificial Photosynthetic Membranes" *ACS Appl. Mat. & Interfaces*, **3**: 1003 – 1008 (2011)

(7) I. Yahyaie, **K. McEleney**, M. Walter, D. Oliver, D. J. Thomson, M. S. Freund*, N. S. Lewis*: "Electrical Characterization of Si-Microwires and their Junction with Conducting Polymer Composites" *J. Phys. Chem. lett.* **2**: 675–680 (2011)

(8) **S. L. McFarlane**, *B. A. Day*, **K. McEleney**, M. S. Freund*, N. S. Lewis*: "Designing Electronic/Ionic Conducting Membranes for Artificial Photosynthesis" *Energy Environ. Sci.*, **4**: 1700 – 1703 (2011) *Cover article*

(9) M. Pilapil, R. G. Pillai, M. S Freund*, J. H. Zhao and D. J. Thomson*: "Scaling and Anisotropic Conduction in Electrochemically Deposited Polypyrrole Hybrid Junctions" *IEEE Electron Device Letters, in press*

(10) S. Bhadra, G. E. Bridges*, D. J. Thomson and M. S. Freund: "A Wireless Passive pH Sensor Based on pH Electrode Potential Measurement" *Sensors, 2010 IEEE*, 927 – 930 (2010)

(11) **S. L. McFarlane, B. A. Deore**, *N. Svenda*, M. S. Freund*: "One-Step, Organic-Solvent Processable Synthesis of PEDOT Thin Films *via In Situ* Metastable Chemical Polymerization" *Macromol.* **43**: 10241–10245 (2010)

(12) G. M. Suppes, C. G. Cameron, and M. S. Freund*: "A Polypyrrole/Phosphomplybdic Acid Poly(3,4-ethylenedioxythiophene)/Phosphtungstic Acid Asymmetric Supercapacitor" *J. Electrochem. Soc.* **157**: A1030-A1034 (2010)

(13) S. Neethirajan, M. S. Freund*, D. S. Jayas*, C. Shafai, D. J. Thomson, N. White: "Development of Carbon dioxide (CO_2) Sensor for Grain Quality Monitoring" *Biosys. Eng.* **106**: 395-404 (2010)

(14) **S. Rudenja*** and M. S. Freund*: "Photoexcitation of Intrinsic Plasmon in Emeraldine Electroactive Device" *J. Electrochem. Soc.* **157**: H787-H791 (2010)

(15) J. H. Zhao, D. J. Thomson*, M. Pilapil, R. G. Pillai, **G. M. A. Rahman** and M. S Freund*: "Field Enhanced Charge Carrier Reconfiguration in Electronic and Ionic-coupled Dynamic Polymer Resistive Memory" *Nanotechnology*, **21**: 134003 (2010)

(16) R. G. Pillai, *M. D. Braun* and M. S. Freund*: "Electrochemically Assisted Self-Assembly of Alkylthiosulfates and Alkanethiols on Gold: The Role of Gold Oxide Formation and Corrosion" *Langmuir*, **26**: 269-276 (2010)

(17) **G. M. A. Rahman**, J. H. Zhao, D. J. Thomson*, and M. S. Freund*: "Compensation Doping in Conjugated Polymers: Engineering Dopable Heterojunctions for Modulating Conductivity in the Solid State" *J. Am. Chem. Soc.* **131**: 15600-15601 (2009)

(18) **B. A. Deore** and M. S. Freund*: "Self-doped Polyaniline Nanoparticle Dispersions Based on Boronic Acid-Phosphate Complexation" *Macromolecules*, **42**: 164-168 (2009).

(19) M. Schindler*, M. S. Freund, F. C. Hawthorne, P. C. Burns and P. A. Maurice: "The Dissolution of Uranophane: An AFM, XPS and SEM study," *Geochim. Cosmochim. Acta*, **73**: 2510-2533 (2009).

(20) J. H. Zhao, D. J. Thomson*, R. Gopalakrishna Pillai and M. S. Freund*: "Dynamic Resistive Crossbar Memory Based on Conjugated Polymer Composite" *Appl. Phys. Lett.* **94**: 092113 (2009).

(21) M. Schindler*, F. C. Hawthorne, M. S. Freund and P. C. Burns: "XPS Spectra of Uranyl Minerals and Synthetics: I. The U4f Spectrum," *Geochim. Cosmochim. Acta*, **73**: 2471-2487 (2009).

(22) M. Schindler*, F. C. Hawthorne, M. S. Freund and P. C. Burns: "XPS Spectra of Uranyl Minerals and Synthetics: II. The O1s Spectrum," *Geochim. Cosmochim. Acta*, **73**: 2488-2509 (2009).

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Talks

Invited Talks

(1) "Manipulating Conjugated Polymer Structure and Chemistry: Creating Active Materials for Applications in Electronics and Energy Storage/Conversion" University of Florida, July 7, 2011
(2) "Controlling Conducting Polymer Structures and Properties" University of Montreal, April 6, 2011
(3) "Controlling Conducting Polymer Structures and Properties" Dalhousie University, March 11, 2011
(4) "Controlling Conducting Polymer Structures and Properties" Acadia University, March 10, 2011
(5) "Optimizing Conjugated Polymer Composites for Electronic Applications" University of Central Florida, January 6, 2011.

(6) "Optimizing Conjugated Polymer Composites for Electronic Applications" 93nd Canadian Chemistry Conference, May 31, 2010.
(7) "Controlling Conducting Polymer Structures and Properties" Queens University, April 16, 2010
(8) "Conjugated Polymer, Metal Oxide-Based Heterojunctions for Electronic Applications" 92nd Canadian Chemistry Conference, May 31, 2009.
(9) "Controlling Conducting Polymer Structures and Properties" University of Guelph, November 4, 2008.
(10) "Complementary Techniques for Chemical and Structural Characterization of Advanced Materials" 47th Annual Conference of Metallurgists, August 25, 2008.
(11) "X-ray Photoelectron Spectroscopy: Instrument Operation and Applications" Pan-American Synchrotron Radiation Instrumentation conference, June 10, 2008.
(12) "Conducting Polymer Nanoionic Composites for Electronic Applications" 91st Canadian Institute of Canada conference, May 27, 2008.
(13) "Manipulating Conjugated Polymer Structure and Chemistry: Creating Active Materials for Sensing and Electronic Applications" 22nd Western Canadian Undergraduate Chemistry Conference, May 3, 2008.
(14) "Controlling Conducting Polymer Structure and Properties via Polymerization Kinetics, Functionalization and Composites" University of Regina, March 20, 2008.
(15) "Controlling Conducting Polymer Structure and Properties via Polymerization Kinetics and Functionalization" University of Central Florida, March 16, 2007.
(16) "Controlling Conducting Polymer Structure and Properties via Polymerization Kinetics and Functionalization" University of Alberta, February 2, 2007.
(17) "New Strategies for Tackling Processability and Mechanical Property Issues of Conducting Polymers" Memorial University of Newfoundland, December 11, 2006.
(18) "Poly(anilineboronic acid): from Sensors to Nanostructures" Electrochemical Society Canadian Symposium, Lakehead University, September 29, 2006
(19) "Synthesis of Tunable Conducting Poly(anilineboronic acid) Nanostructures: From Particles to Films to Fibers" 232nd ACS National Meeting, San Francisco, September 12, 2006
(20) Thermo Electron - 2006 Research Symposia Series - Advanced Applications of Vibrational Spectroscopy, Chicago, May 7, 2006
(21) "New Strategies for Tackling Processibility and Mechanical Property Issues of Conducting Polymers" Electrochemical Society, Canadian Section, May 28, 2005
(22) "The Materials Scientist's Tool Box" University of Manitoba, sponsored by the Office of Research, March 24, 2005
(23) "Electronically Conducting Polymers: Opportunities and Challenges," Annual General Meeting of the CIC Manitoba Local Section, June 17, 2004
(24) "New Strategies in Self-Assembly and Conducting Polymer Research," University of Winnipeg, March 4, 2003
(25) "New Strategies in Self-Assembly and Conducting Polymer Research," University of Manitoba, November 22, 2001
(26) "New Strategies in Self-Assembly and Conducting Polymer Research," Steacie Institute for Molecular Sciences, NRC, November 16, 2001
(27) "New Strategies in Self-Assembly and Conducting Polymer Research," University of Ottawa, October 28,2001
(28) "New Strategies in Self-Assembly and Conducting Polymer Research," University of Saskatchewan, September 5, 2001

(29) "Material Science Research in the Beckman Institute: from Sensors to Solar Cells," Université du Québec à Montréal, May 7, 2001.
(30) "Electrochemically Directed Self-Assembly on Gold," *Invited submission to the FACSS Conference* ***Young Investigator Symposium***, September 26, 2000.
(31) "Recent Advances in the Development of Polymer-based, Non-enzymatic Glucose Sensors," 83rd Canadian Institute of Canada Conference, May 28, 2000.
(32) "Electrochemically Directed Self-assembly on Gold," 83rd Canadian Institute of Canada Conference, May 28, 2000.
(33) "Conducting Polymers: Enhancing Processablity and Mechanical Properties without Destroying Conductivity," AMP Inc., October, 12, 1998.
(34) "New Synthetic Approaches for the Preparation of Chemically Diverse Electrode Interfaces," University of Delaware, May 11, 1998.
(35) "Controlled Chemical Modification and Cross-Linking of Polyaniline Interfaces and Thin Films," 214th National ACS meeting, September 10, 1997.
(36) "Controlled Chemical Modification and Cross-Linking of Polyaniline Thin-Films," 191st National Electrochemical Society Meeting, May 9, 1997.
(37) "Controlled Chemical Modification of Polyaniline Thin-Films," Saint Lawrence University, April 22, 1997.
(38) "Controlled Chemical Modification of Polyaniline Thin-Films," SUNY Pottsdam, April 22, 1997.
(39) "Feed-forward Neural Network Processing of Voltammetric Data," Hofstra University, March 19, 1997.
(40) "Feed-forward Neural Network Processing of Voltammetric Data," Philadelphia Section of the Electrochemical Society Meeting, January 21, 1997.
(41) "Controlled Chemical Modification and Cross-Linking of Polyaniline Thin-Films," Sandia Livermore National Laboratories, January 17, 1997.
(42) "Controlling the Interfacial Chemistry of Polyaniline with Benzenediazonium Salts," 190th National Electrochemical Society Meeting, October 9, 1996.
(43) "Artificial Neural Network Processing of Complex Electrochemical Responses: Determining Heavy Metal Concentrations under Difficult Circumstances," Villanova University, September 10, 1996.
(44) "Nucleophilic Substitution Reactions of Polyaniline with Substituted Benzenediazonium Ions: A Facile Method for Controlling the Surface Chemistry of Conducting Polymers," 79th Canadian Society for Chemistry Conference and Exhibition, June 23, 1996.
(45) "Feed-forward Neural Network Processing of Voltammetric Data," 79th Canadian Society for Chemistry Conference and Exhibition, June 23, 1996.

Contributed Talks

(46) "Tunable Conducting Polymer Nanostructures: From Particles to Films to Fibers," Gordon Conference on Electrochemistry Open Session, February 15, 2006.
(47) "Boronic Acid Substituted Polyaniline: New Possibilities for the Facile Synthesis of Polyaniline with Enhanced Properties" Canadian Society for Chemistry Conference and Exhibition, May 29, 2004.
(48) "Synthesis and Characterization of a Chemically-Reversible, Self-Doped Polyaniline" Canadian Society for Chemistry Conference and Exhibition, August 12, 2003.
(49) "Electrosynthesis of SAMs on Gold," Gordon Conference on Electrochemistry Open Session, January 21, 2000.

(50) "Direct Spectroscopic Evidence for Facile Air Oxidation of Self Assembled Monolayers on Gold in the Absence of Light," Gordon Conference on Electrochemistry Open Session, January 21, 1998.

(51) "Feed-forward Neural Network Processing of Voltammetric Data," Paper 100, The Pittsburgh Conference, March 4, 1996.

(52) "Nucleophilic Substitution Reactions of Polyaniline with Substituted Benzenediazonium Ions: A Facile Method for Controlling the Surface Chemistry of Conducting Polymers," Gordon Conference on Electrochemistry Open Session, January 18, 1996.